

bility to some earlier returns. With regard to the coming apparition, Professor Holetschek, Dr. Smart, and others have published ephemerides to facilitate its recovery. The magnitudes assigned by the first-named astronomer show that, notwithstanding improved modes of search, there has hitherto been little chance of success.

Solar Activity in 1908.

Sun-spots.—Although several very fine spots have been seen on the Sun's surface during the year, especially two at the end of August and the middle of September, yet the general character, size, and positions of the spots denoted a decline in the solar activity. The first quarter of the year was marked by a quiet period, succeeding the great outbursts witnessed in November and December 1907. The groups observed were of no great area, and bright faculæ were relatively scarce, and mostly seen on the E. limb. The spot groups, too, were generally of the character denoted by Types I. and IV. which mark the quiet and dying phases of spot activity, with a very noticeable dearth of spots represented by the active Types II. and III. And in general this was the character of the spot groups observed during the year, with the exception of some outbursts to be noted directly. The long processions of groups prevalent in the years 1906, 1907 were replaced by a series of many round regular quiet spots, several of them affording excellent material for testing the Wilsonian hypothesis of sun-spot level.

The first active period of the year set in with the beginning of April, announced, as is so often the case, by the appearance of a bright compact patch of faculæ on the E. limb, and lasted until the middle of the month, with somewhat of a revival when the groups returned again at the end of the month. Even so, the general type of the spots noted above was preserved. But the faculæ were brighter and more abundant. A quiet May was followed by a revival of activity at the beginning of June, which was of no long duration, the quiet spell that succeeded lasting until the end of July. But now began the most active period of the year, covering the months of August and September, four of the groups observed being visible to the naked eye. The middle of August was marked by four fine groups, and an exceedingly fine group appeared towards its close. This, the biggest group of the year, was on the central meridian on August 31.2, and on August 30 covered a total area of about 1500 millionths of the visible disc. The next in size was group 6522 of the Greenwich series, which was on the central meridian on September 10.3 and was accompanied in its passage by a very violent magnetic storm, the greatest of the year. The region in which it appeared had been the seat of the great sun-spot group of November 1907 which had itself synchronised in its first passage across the disc with two days of great magnetic storm. However, after the fourth appearance of this same group, central on February 4.9, 1908, the region had

remained dormant until this revival of August. These greater disturbances showed the characteristics of the active Types II. and III., but, even so, they were very penumbral in appearance, being apparently not very deep spots. They died out finally about the middle of October, which was on the whole a very quiet month, October 15 being the only spotless day in the Stonyhurst records of 187 drawings during the year. November, too, was quiet, with the exception of a fairly active period from the 8th to the 14th, while December, except for the appearance of a couple of fine round spots, was even quieter.

With regard to the positions of the groups, if they are counted, great and small, independently of their size, the following is the result.

	N. hemisphere.	S. hemisphere.
Groups in latitudes above 20° . . .	2	7
„ „ „ between 20° – 10° . . .	56	74
„ „ „ „ 10° – 0° . . .	41	53
Totals . . .	99	134

It appears that the southern hemisphere was on the whole the more active, and that in both hemispheres about 40 per cent. of all groups were in latitudes lower than 10° , amongst them being the biggest groups of the year. This tendency of the groups to close in towards the equator is a further indication of the decline of activity. At the same time the long spell of sun-spot outbursts which has been witnessed since 1905 is to be noted, and is probably due, as Professor Schuster points out (*Nature*, November 5, 1908), to the overlapping of the well-marked period of 4.79 years upon the eleven-year period. The regions of special activity, that is in which there was a general clustering of the groups observed, were for both hemispheres bounded by longitudes 150° – 185° , latitudes north and south 5° – 18° , and in addition, for the north hemisphere that comprised within longitudes 250° – 290° , latitudes 5° – 15° , and for the south hemisphere the region longitudes 200° – 230° , latitudes 10° – 22° .

A. L. C.

Prominences.—The daily frequency of prominences during 1908, as deduced from spectroheliograms taken on 38 days on various dates extending from April to November, is given below.

The photographs used were taken with the “K” line (calcium) of the solar spectrum by means of the spectroheliograph of the Solar Physics Observatory, South Kensington. No discrimination as to size has been made, except that the lower limit for height of prominences accepted was from $20''$ to $30''$. The result shows a considerable decrease in the total activity as compared with the similarly obtained records for previous years.

Judging from the information thus available, the prominence frequency is rapidly on the downgrade, while the preponderance of activity in the southern hemisphere is more marked than in 1907. On the plates examined, there was little evidence of action at either

pole, the maximum number of disturbances occurring in spot latitudes and immediately higher. Equatorial prominences were not infrequent.

The data for the last four years, as deduced at South Kensington, are as follows:—

	1905.	1906.	1907.	1908.
North hemisphere	3·4	3·9	3·5	2·5
South hemisphere	3·0	2·6	3·9	3·1
Total daily frequency	6·4	6·5	7·4	5·6

The fewness of the number of days on which it has been possible to obtain good prominence records makes the above figures merely suggestive, and not final.

The poor observing weather of 1908, combined with the unfavourable situation at South Kensington, has very effectively militated against a fuller record.

In previous reports I have been able to include observations made during the first six months of the year by A. Riccò, but up to the present these are not available.

W. J. S. L.

Solar Research.

Sun-spot Spectra.—The first portion of a “preliminary catalogue of lines affected in sun-spots,” based upon photographs taken at Mount Wilson, and covering the region λ_{4000} to λ_{4500} , has been published by Adams (*Ap. J.*, xxvii. 45). The behaviour of nearly nine hundred lines is indicated.

Following Fowler’s identification of the banded spectrum of magnesium hydride in spots, Olmsted, of the Mount Wilson laboratory, has found that an arc burning between poles of metallic calcium in an atmosphere of hydrogen gives a number of bands, the two most prominent of which account for the well-known spot bands in the red near 6382 and 6389. From experimental evidence, it is considered probable that the bands in question are produced by some compound of calcium and hydrogen (*Ap. J.*, xxvii. 66).

Father Cortie has drawn attention to the apparent strengthening in sun-spots of many lines which are attributed to water vapour, which has led him to suggest the possible existence of water vapour, in the form of superheated steam, over sun-spots (*Ap. J.*, xxviii. 379).

The Mount Wilson equipment for the investigation of sun-spot spectra has been extended by the erection of a vertical telescope of 60 feet focal length combined with a spectrograph of 30 feet focal length. The coelostat and objective are placed at the summit of a skeleton steel tower about 60 feet high, while the spectrograph, which is of the autocollimating type, occupies a circular wall $8\frac{1}{2}$ feet in diameter and 30 feet deep. The reduced atmospheric